APPLICATION OF LEED™ PRINCIPLES

to ANL & Fermilab Buildings

November 21, 2003

8:00 a.m. – 12:00 p.m.

Wilson Hall 1 North

BACKGROUND AND INTRODUCTION TO LEED™

8:00 Welcome and Introductions

8:20 Orientation to LEED™ Rating System

8:40 Drivers, Costs and Benefits of LEED™ Certification

LEED™ ANALYSIS FOR FERMILAB BUILDINGS

9:10 Study Methodology

9:20 Scorecards for Three Projects

10:00 Break

10:20 Cost Analysis for Lab-BEG

11:30 Questions/Discussion/Conclusions

12:00 Adjourn

APPLICATION OF LEED™ PRINCIPLES

to ANL & Fermilab Buildings

Orientation to LEED™ Rating System

A Decade-Long Movement

Organizational Evidence

- 1989: AIA Committee on the Environment
- 1991: ASTM Green Building Committee

A Range of Definitions

- BREEAM – British, 1990
- BEPAC – Canada, 1994
- HK-BEAM -- Hong Kong (pilot)
- LEED – U.S., 2000

LEED and DOE

- ANL:
  - Central Supply Facility – LEED Silver
  - Center for Nanoscale Materials (In progress)
- SNL:
  - 5 projects registered to be LEED certified
  - 1 project won White House award, but not LEED
  - All new line items will be LEED;
  - All new GPPs will do a SD Report
- LANL: No LEED, but good SD Guide developed by NREL
- Complex-wide web-site: www.pnl.gov/doesustainabledesign/

Sandia National Laboratories

"Green" Conference Room

Carpet

25% of post-consumer reclaimed fiber; 75% of production waste is recycled; backing is 100% recycled.

Features

High wear resistance; zero VOC adhesives during installation

Cost

30-40% savings

Wallcovering

100% natural (organic, farmed, by-products composted).

Features

Non-flammable; durable; noise reduction; diffuses reverberation; 100% recyclable

Cost

~50% savings

Ceiling Tiles

70% recycled material; high % of water recycling; reuses 90% of scrap.

Features

100% recyclable; high acoustical performance; ~ 90% light reflectance; superior resistance to sagging

Cost

Same

Sandia National Laboratories

Model Validation Testing Center

- 20,000 ft^2 rehabilitated building
- Upgrades ability to monitor, analyze and view remote testing
- Performance-based, design-build contract
- Program of Requirements included an SD section - part of contractor selection.

- Charrette was part of design process - established the SD roadmap
- Whole building approach used during Schematic Design
- SD Report submitttals and final SD report based on LEED template

Sandia National Laboratories

Model Validation –SD Elements

•Rehabilitate Building (70%), reuse equipment
•Local, drought tolerant landscaping, water harvesting
•Integrated Building Envelope
–High performance, low-e glazing, thermally broken
–TPO membrane roof (R30)– white color

•Construction waste management plan; recycled 66% of all waste
•IAQ management plan
-2 week building flush-out

•Local and environmentally preferable materials.

APPLICATION

to ANL & Fermilab Buildings

MVSCTC - DAYLIGHTING

South façade before

South façade after

- Ambient, task and accent lighting
- Daylight controls
- High performance, low-e glazing, thermally broken frames
- Window overhangs

APPLICATION OF LEED™ PRINCIPLES

to ANL & Fermilab Buildings

Drivers, Costs and Benefits of LEED™ Certification

DOE Drivers for Sustainable Design

- DOE 413.3: Program and Project Management for the Acquisition of Capital Assets
  - "Sustainable Design Principles must be applied to the siting, design, and construction of new facilities"
- DOE 430.2A Energy Management and Water Conservation
  - Contractor requirements document – requires a sustainable design report
- E.O. 13101: Greening the Government through Waste Prevention, Recycling, and Federal Acquisition

E.O. 13101

Building Products Covered

- insulation
- carpet and carpet cushion
- cement and concrete
- flowable fill
- paint
- floor tiles and patio blocks
- shower and restroom dividers or partitions
- structural fiberboard and laminated paperboard
- plastic lumber landscape timbers and posts

Reasons for NOT Buying

- schedule
- performance
- price

Incentives

- ➔ Recognition
  - DOE Awards
  - EPA Closing the Circle Awards
  - Leadership opportunities
  - Public recognition
- ➔ Funding Opportunities
- ➔ Triple Bottom Line
  - Economics: Saves money and resources
  - Environment: Reduces environmental impacts
  - Social: Healthier more productive work environments
- ➔ DOE Performance Goals

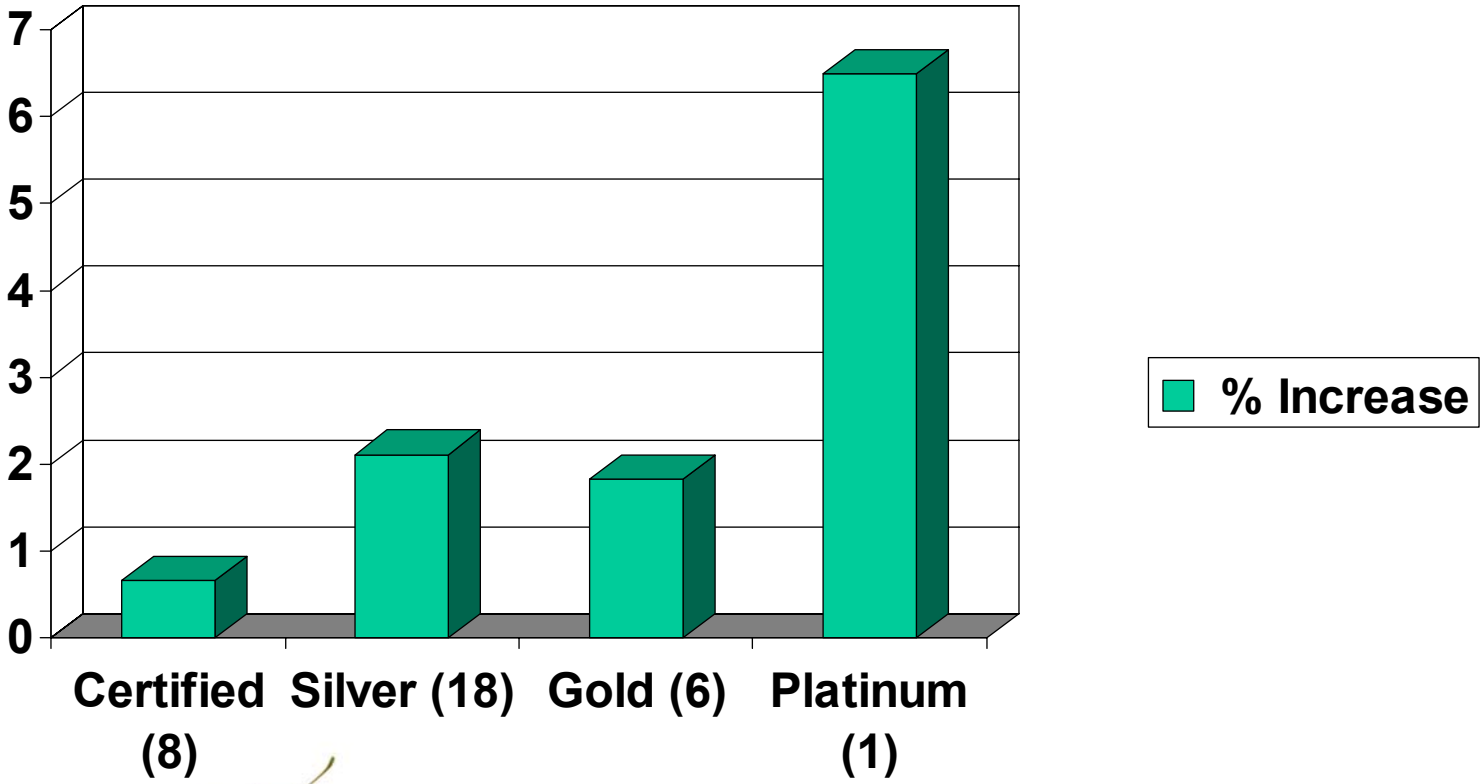
Costs and Benefits of LEED

- California study of 33 LEED Buildings, October, 2003:
  - "The Costs and Financial Benefits of Green Buildings"
    A Report to California's Sustainable Building Task Force
- FEMP study, October, 2003
  - "The Business Case for Sustainable Design in Federal Facilities"
- October 2003 USGBC GreenBuild Conference
  - "Defining LEED Costs for the USGSA"
  - "Managing the Cost of LEED"
- Case Study: ANL-CSF

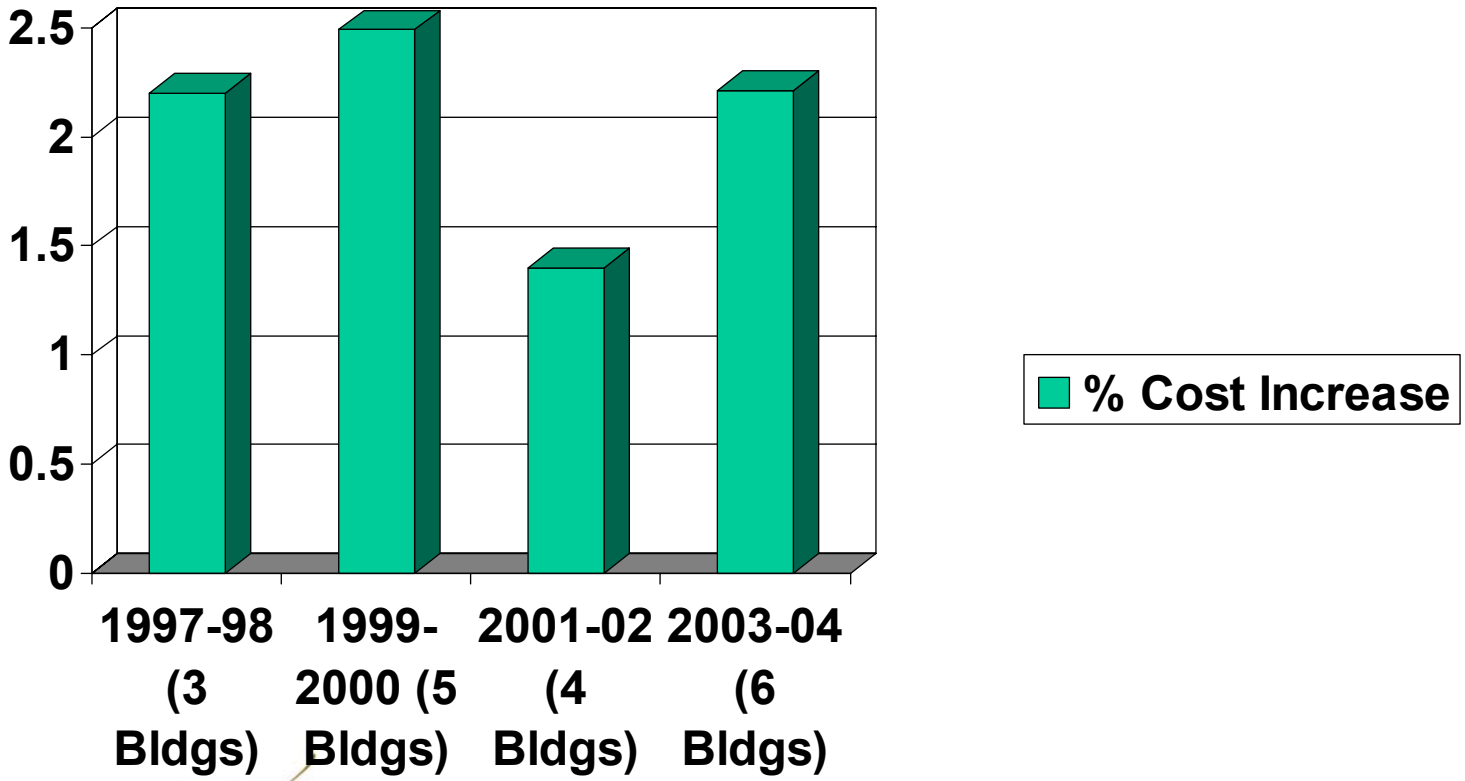
Challenges to Costing

- Many green buildings are one-time “showcase” projects
- There’s a learning curve cost for the first green building
  - Of a client
  - Of a design/architectural firm
- Relative newness of technologies and products can lead to over-sizing of systems or limited use of products, losing full cost benefits
- Estimators may add uncertainty factors for new technologies they are not familiar with

Average Cost Premium vs. Level of Certification



Cost Premium vs Year for Silver Ratings



Evidence of the Learning Curve

- Portland's 3 LEED Silver Buildings
  - 1995: 2% premium
  - 1997: 1% premium
  - 2000: 0% premium

- City of Seattle
  - Program onset (several years ago): 3-4% premium
  - Today: 1-2% premium

“Silver for Free” if…

- LEED Silver is required in the RFQ for the design team and embedded within construction documents, building construction, and commissioning;
- Design Team has sustainable design embedded within their culture
- Contractors, Property Managers, Real Estate Analysts, Budget Analysist, Crew Chiefs and Custodians are included on the Design Team.
- Selected strategies are “whole system” in nature and integrated design solutions are pursued that cannot be peeled off from the base project as “add alternates”.

Costs are Reasonable When You Consider…

- Life cycle costs are below conventional buildings (2% first cost yields 20% life cycle savings)
- Better design reduces change orders
- Advanced energy efficiency for pennies per square foot
- On average, green buildings use 30% less than conventional buildings

FEMP Highlights

www.eere.energy.gov/femp/techassist/sustainability.html#business

Beyond first costs to Life Cycle Costs:

- Decreased energy and water costs
- Lower maintenance and repair costs
- Reduced absenteeism and increased productivity
- Increased building valuation
- Health, comfort and well-being of occupants
- Building safety and security, decreased insurance rates
- Lower air emissions
- Reduced solid waste generation
- Decrease natural resource use

FEMP Prototype Building

Feature	First Cost	Annual Savings ($/yr)
E2 Measures	+$38,000	-$4,300
Commissioning	+$4,200	-$1,300
Water efficiency	-$590	-$330
Landscaping and stormwater mgmt	+$5,600	-$3,600
Sustainable Materials	-$51,000	-$0
Subtotal	-$3,790	$9,530

FEMP-Material Cost Savings

- Concrete with slag or fly ash: $0.50 to $1.00 less per ton
- Recycled content carpet: up to $15 less per yard
- Low emitting paint: $3 less per gallon
- Recycled paint: up to $15 less per gallon
- Certified wood doors: up to $150 less
- Waterless urinals: up to $280 less, if you consider piping

Common Cost Inflators

- Lack of a clear green design goal
- Mid-stream attempts to incorporate green
- Decentralized management of the process
- Lack of experience with LEED
- Insufficient Time/Money

Managing the Costs

Don't even think of LEED unless…

- You have support from senior decision makers
- LEED can be started during conceptual design
- The project scope is significant, including systems and finishes
- The project can meet all of the prerequisites

LEED Documentation Costs…

- As low as $10,000 for an experienced team
- Most first-timers report costs of $30,000 - $60,000

Case Study: ANL-CSF

LEED Associated costs

• Consultants and commissioning	$75,000
• A/E effort additional options	$10,000
• Construction	$45,000
• LEED application effort	$38,000
Total	$168,000
	2.85% of TEC

CSF Features

- Fly ash aggregate in concrete
- Recycled concrete block
- Pulverizing and reuse of existing gravel asphalt & sub-base
- Reuse of existing excavated soil
- Recycled concrete curbs
- Native trees and grass seed
- Roof drainage into existing wetland
- High performance windows selective to West and North
- Clerestory windows
- Recycled structural steel
- Recycled sustainable lumber
- Natural linoleum floor
- Recycled content carpeting
- White roof
- Low VOC and lead free paints
- Recycled content ceiling tiles
- Gypsum Board with recycled content

Lessons Learned from the PM

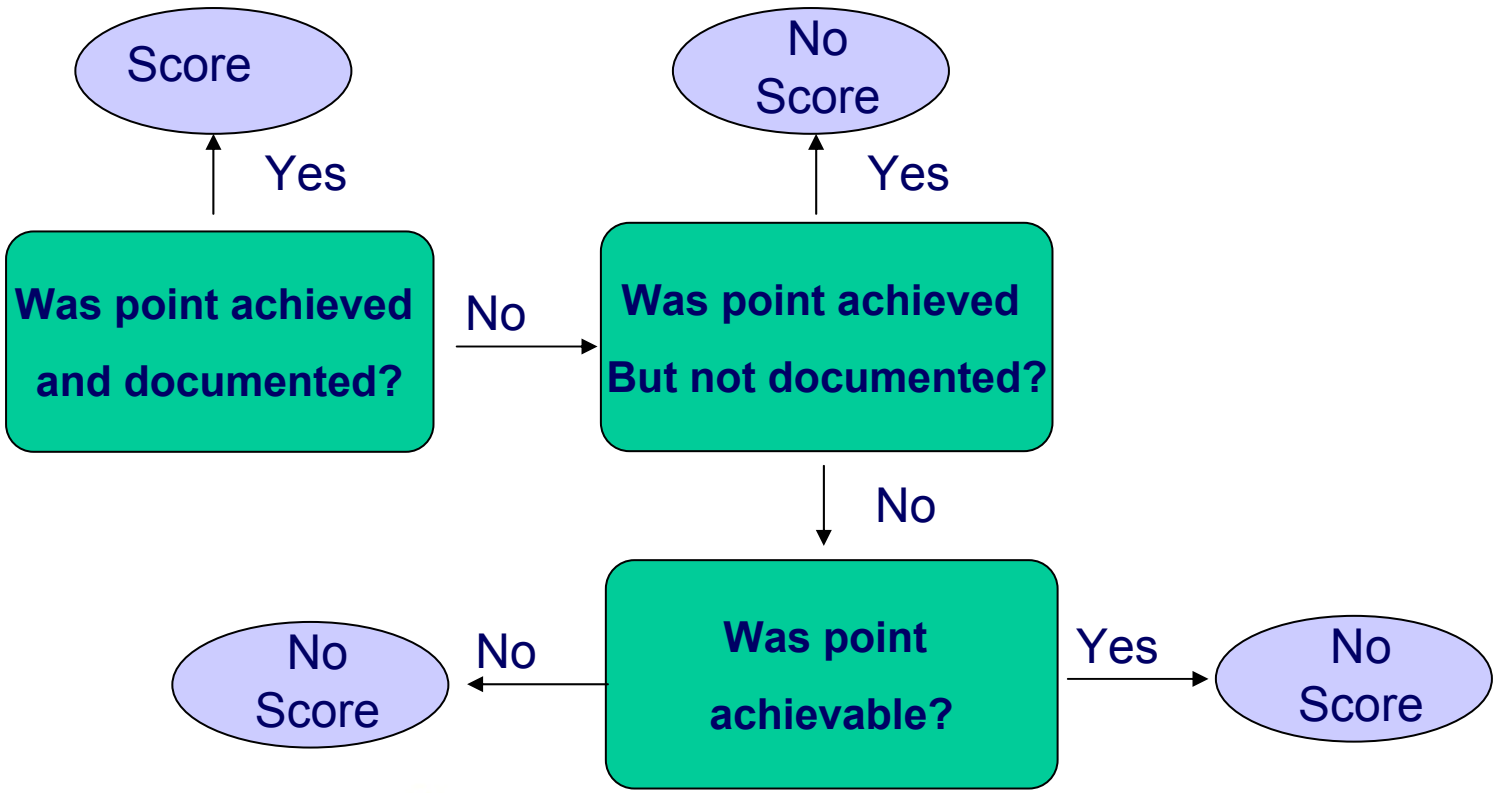
- Future ANL projects can achieve a higher rating at lower cost
- Utilize the LEED “gimmees” that apply to any ANL project
- USGBC comments on the CSF will help inform future projects
- Initiate all LEED pre-requisites during Title I design
- Review and document throughout the process rather than at the end

APPLICATION OF LEED™ PRINCIPLES

to ANL & Fermilab Buildings

Study Methodology

LEED Score Evaluation

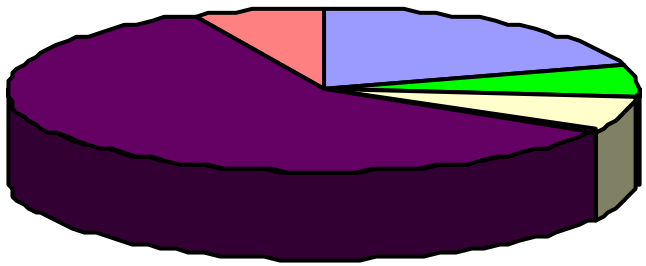


APPLICATION OF LEED™ PRINCIPLES to ANL & Fermilab Buildings

Scorecards for Three Projects

- LAB B/E/G
- MuCool
- MI-3

Scorecard Results – Lab B/E/G

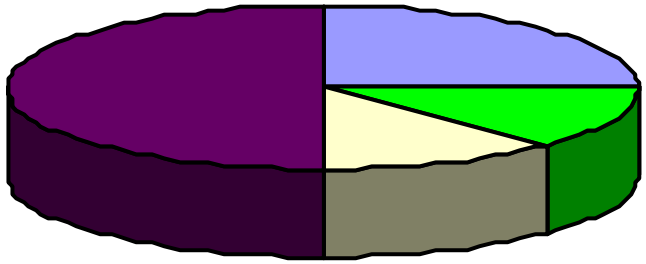


Total Points – 15

How achieved?

- No farmland, flood plain, endangered habitat, or park
- Restoration of open space
- Stormwater runoff decrease
- No irrigation
- No HCFC or Halon use
- Permanent CO2 monitoring system
- SMACNA/MERV/ASHRAE compliance
- 2 week flushout scheduled
- Low emitting materials (2)
- Proper entryways, no chem use
- Daylight and Views for Spaces

Scorecard Results – MI-31

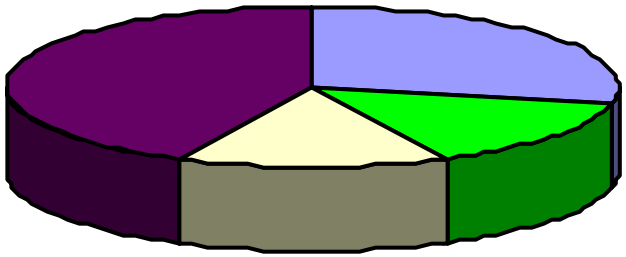


How achieved?

- No farmland, flood plain, endangered habitat, or park
- Stormwater runoff decrease
- No irrigation
- No HCFC or Halon use
- SMACNA/MERV/ASHRAE compliance
- Low emitting materials
- Views for Spaces

Total Points – 8

Scorecard Results – MuCool



How achieved?

- No farmland, flood plain, endangered habitat, or park
- Stormwater runoff decrease
- No irrigation
- No HCFC or Halon use
- SMACNA/MERV/ASHRAE compliance
- Low emitting materials

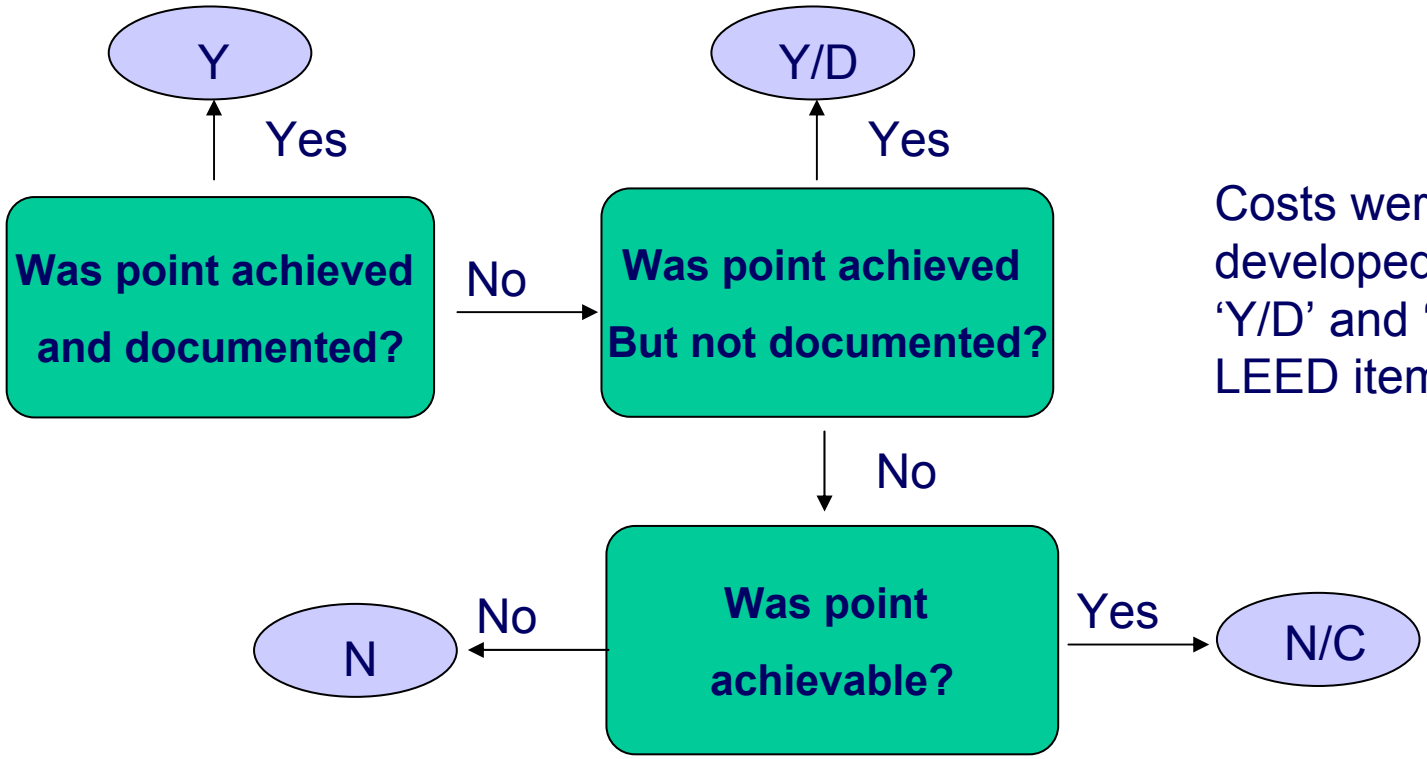
Total Points – 7

APPLICATION OF LEED™ PRINCIPLES

to ANL & Fermilab Buildings

Cost Analysis for Lab-BEG

Costing Categories

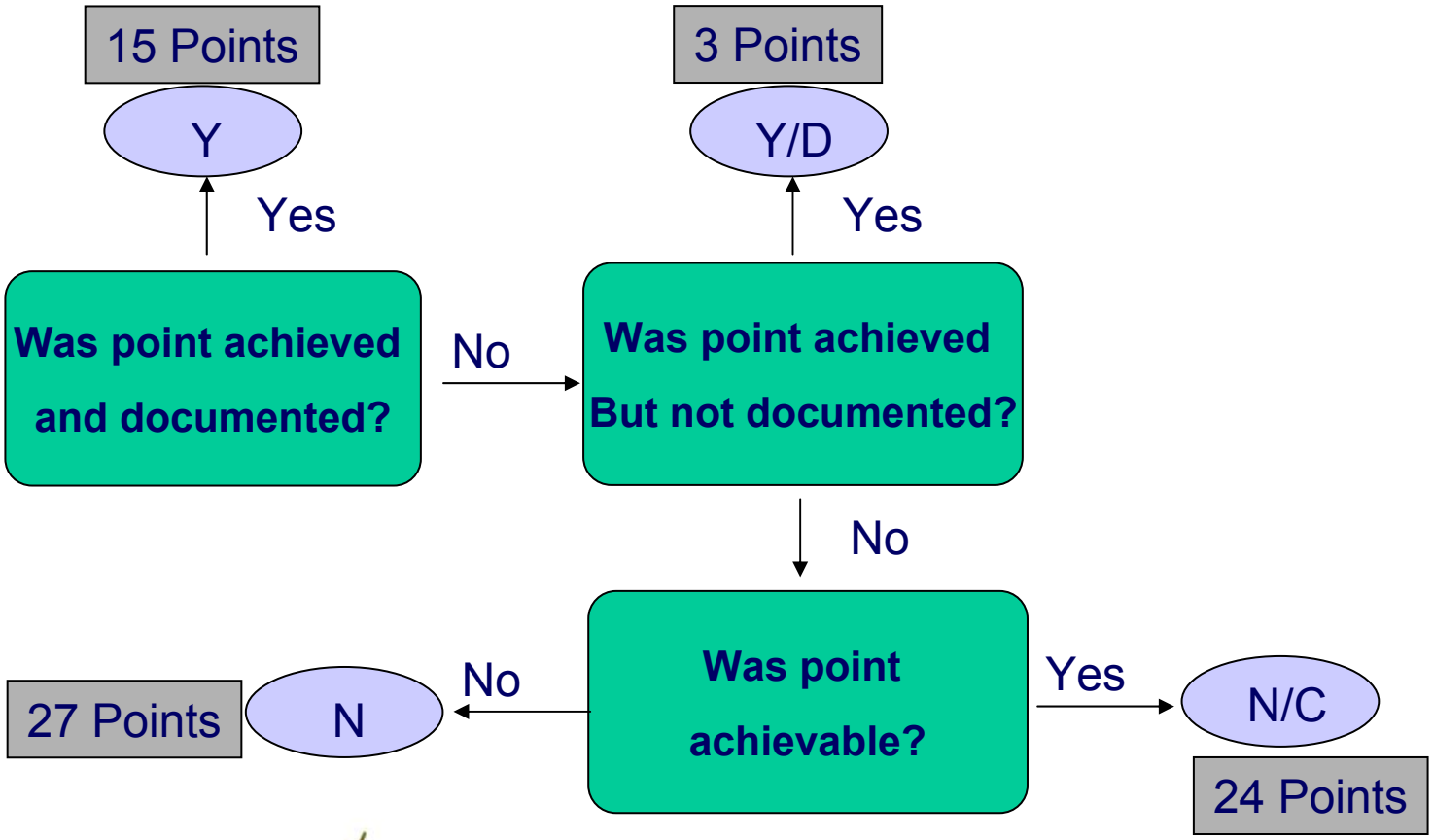


Costs were developed for 'Y/D' and 'N/C' LEED items.

Costing Methods/Assumptions

- Feasibility-level cost estimates
  - Supplier quotes
  - Central Supply Facility Experience
- For each item costed, we considered:
  - Capital
  - Fermilab staff (@$75/hour)
  - A/E hours (@$75/hour)
  - Commissioning costs (@$75/hour)
  - LEED documentation costs (@$75/hour)
  - Lab Tax (@19%)

Summary of Results



Revised Score - Prerequisites

Starting Score: 15 **Ending Score: 32**

Prerequisite	Recommendation	Cost	Revised Score
EA 1	Add'l documentation for bldg cx	$ 9,890	Yes
MR 1	Add glass to recycling service	$0	Yes

Revised Score – SS/WE/EA Credits

Starting Score: 15

Ending Score: 32

Credit	Recommendation	Cost	Revised Score
SS 4.2	Add bike rack, convert showers	$ 2,266	1
SS 4.4	Stripping and signage	$ 460	1
SS 5.2	Add 350 ft2 to contractor's area	$ 0	1
SS 7.2	Galvalume Energy Star roof	($15,000)	1
SS 8	Add shielding, change spacing	$ 2,760	1
WE 2	Piping sinks to stormwater line	$ 2,760	1
WE 3.1	See WE 3.2	$ 0	1
WE 3.2	Waterless urinals, low flow faucets	$ 1,600	1
EA 1.1	Inhouse DOE2 modeling	$ 2,463	2

Revised Score – MR/IEQ/ID Credits

Starting Score: 15 **Ending Score: 32**

Credit	Recommendation	Cost	Revised Score
MR 2.1	Develop/add Waste Mmgt plan, calcs	$ 2,463	1
MR 4.1	Add 25% Recycled Content to project	$ 1,265	1
MR 5.1	Add 25% Recycled Content to project	$ 1,265	1
MR 5.1	See MR 5.1.	$ 0	1
IEQ 7.2	Add rh sensor to control system	$ 2,053	1
ID 1.2	Increase local mat'ls to 40%	$ 1,265	1
ID 1.4	Show 29% downsize in scope	$ 0	1

TOTALS	$15,510	32

APPLICATION OF LEED™ PRINCIPLES

to ANL & Fermilab Buildings

Questions/Discussion/Conclusions